Space Weather Technical Forecast

Issued on Saturday, 07 October 2023 at 13:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-flares throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar Activity is Low, with only minor C-class flares observed in the last 24 hours. There are seven sunspot regions on the visible disc. AR3451 and AR3452 in the northwest are the two largest regions. AR3451 contains a delta spot in the intermediate region, whereas AR3452 has now simplified to a beta spot. AR3454 near south centre disc continues to show minor growth in its trailing portion, with some magnetic complexity apparent. AR3450 in the southwest continues to fade and simplify. The remaining regions all appear to be small and mostly simple at present. Whilst there have been a couple of CMEs assessed in the last 24 hours, none are expected to give significant impacts at Earth. No other Earth-directed CMEs have been observed in coronagraph imagery in the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds as observed at L1 by DSCOVR have gradually declined to background levels, around 370 km/s. Density was above average, with a peak of 12 ppcc, before gradually declining to below average levels. Total magnetic field strength has been mostly weak. The north-south component varied weakly between +/-3 nT. Phi angle has been mostly positive (Away from the Sun). Geomagnetic activity has been Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux was at background to moderate levels. Associated 24-hour fluence was below the Active (1e8 integrated pfu) threshold with a slight rising trend. The observation at 07/0000 UTC was 1.1e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Mainly Low with a chance of Moderate flare activity, mainly from AR3451 and AR3452 in northwest of the disc.

Solar Wind / Geomagnetic Activity: A CME which left the Sun on 05 Oct may give some minor shock component on Day 3 (09 Oct). Wind speeds are currently background, and are expected to remain so until the High Speed Streams (HSS) of CH57 and CH58 arrive at Earth later on Day 3 (09 Oct) and into Day 4 (10 Oct), with wind speeds perhaps reaching elevated levels. However, these are negative polarity coronal holes, which are not favoured for significant geomagnetic response at this time of year. Mostly Quiet to Unsettled geomagnetic activity is expected. There is chance of Active intervals on Days 3 and 4, with a slight chance of G1/Minor storm periods, mainly due to HSS effects.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is most likely to remain at background levels, with a very low risk of enhancements mainly from AR3451 and AR3452. High energy electron flux (greater than 2MeV) is forecast to be at background to moderate levels throughout. Electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

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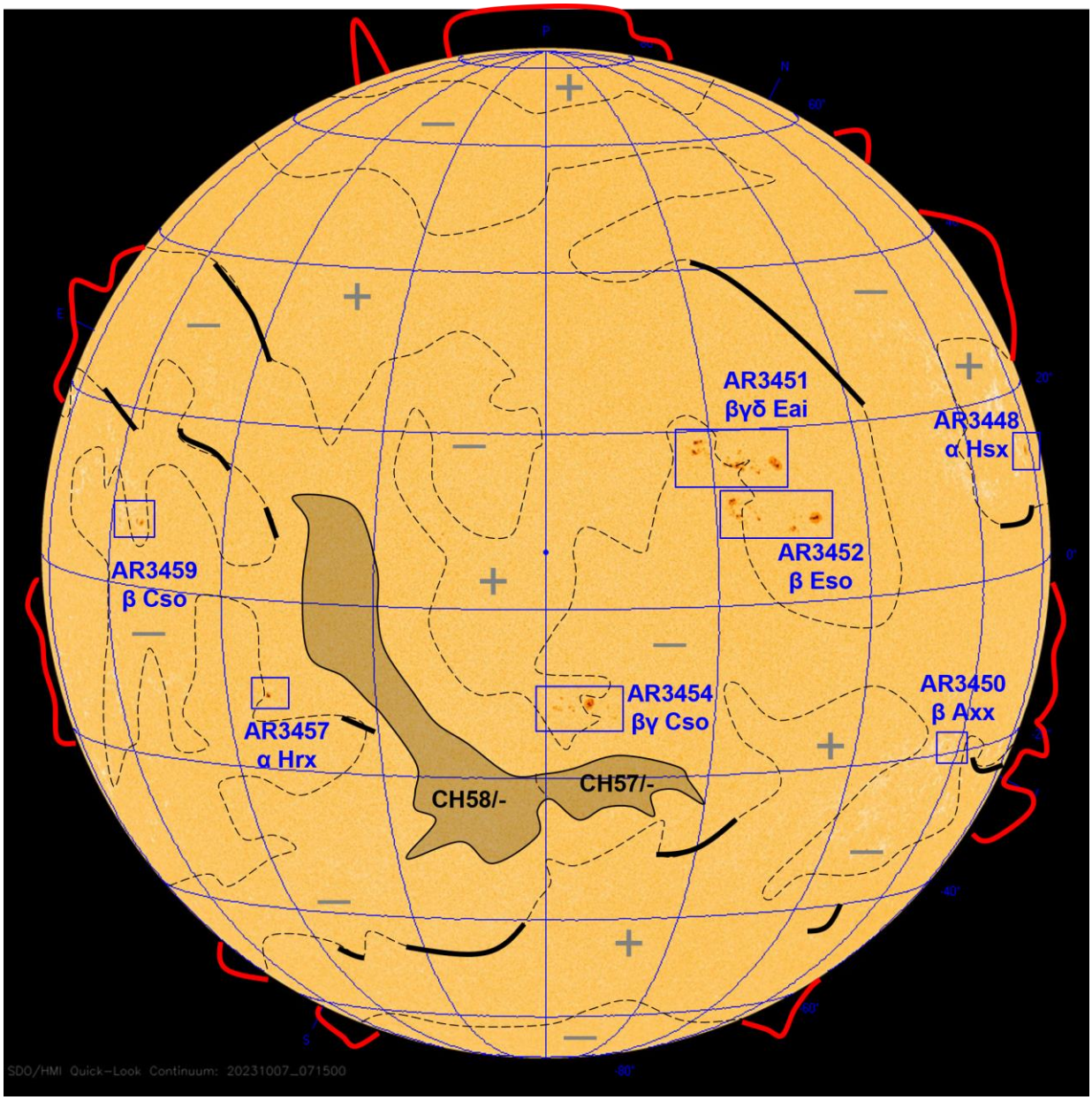
Figure 1. Solar Analysis Valid 07/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

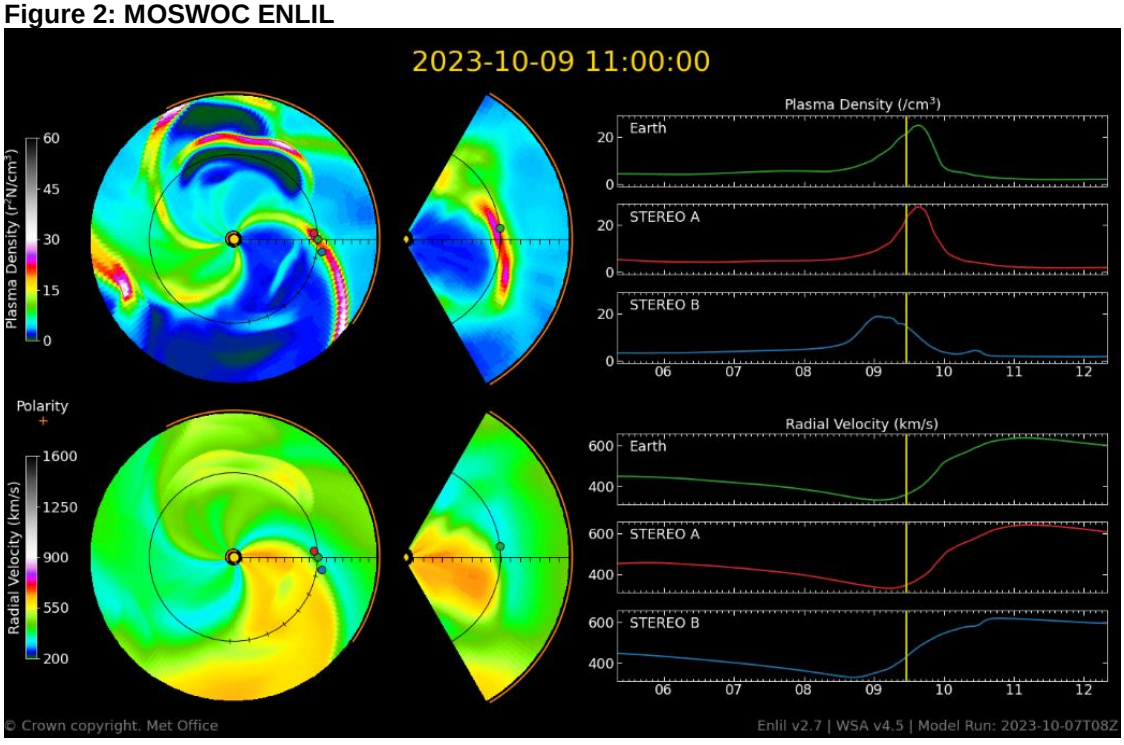
A CME which left the Sun around 05/1930 UTC is mostly directed away from Earth. Whilst there may be some shock component arriving on Day 3 (09 Oct), any impacts from this are expected to be minor.

Wind speeds are currently background, and are expected to remain so until the High Speed Streams (HSS) of CH57 shortly followed by CH58 arrive at Earth later on Day 3 (09 Oct) and into Day 4 (10 Oct), with wind speeds perhaps reaching elevated levels. However, these are negative polarity coronal holes, which are not favoured for significant geomagnetic response at this time of year.

Mostly Quiet to Unsettled geomagnetic activity is expected. There is chance of Active intervals on Days 3 and 4, with a slight chance of G1/Minor storm periods, mainly due to HSS effects.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC ENLIL



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Radio Blackouts - X-Ray Flares:

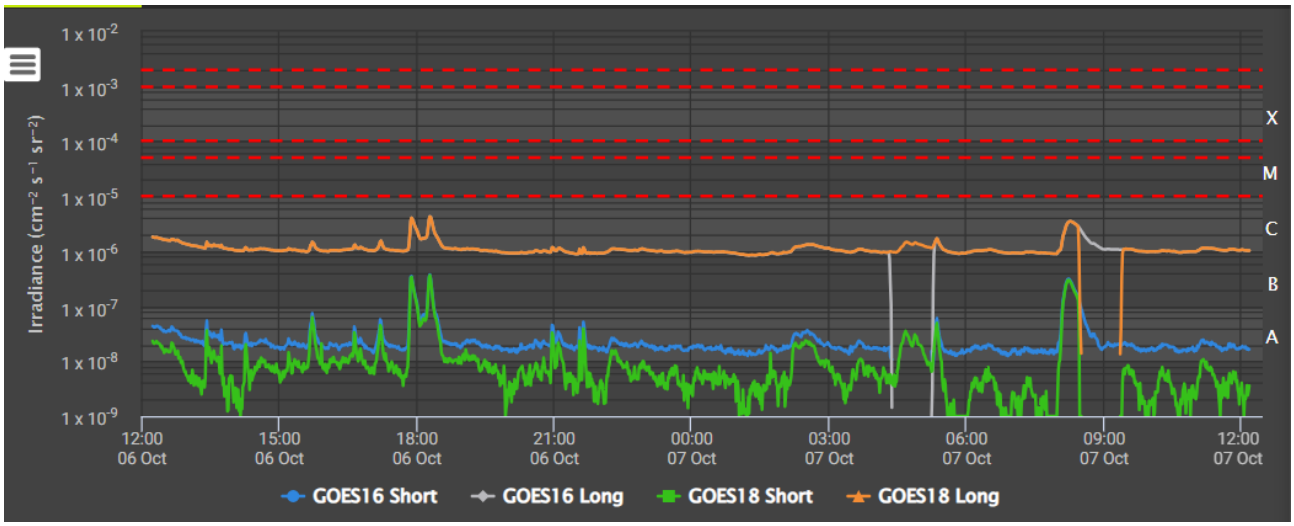
There are currently seven sunspot regions on the visible disc. AR3451 and AR3452 in the northwest are the two largest regions. AR3451 contains a delta spot in the intermediate region, whereas AR3452 has now simplified to a beta spot. AR3454 near south centre disc continues to show minor growth in its trailing portion, with some magnetic complexity apparent. AR3450 in the southwest continues to fade and simplify. The remaining regions all appear to be small and mostly simple at present.

Far side seismographs suggest there are various regions on the far side due to rotate on in the coming days, however it is difficult to assess the likely activity of these regions until they become visible. As such, flare probabilities have been kept flat through this period.

Solar activity is expected to be mainly Low, with a chance of Moderate activity.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 M Class**	No	30	30	30	30
Very Active	**R3 to R5 X Class**	No	5	5	5	5

Figure 3: 24 hours Xray trace



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Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is most likely to persist at background levels. The main risk of any enhancement is from AR3451 and AR3452, which are both now in the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES16 reached mainly moderate levels at the diurnal maximum over the last few days. This is expected to continue through much of the period, with a slight chance of briefly reaching High levels during the diurnal max. The potential CME shock and HSS effects on Day 3 (09 Oct) will likely cause a further suppression in flux.

Electron fluence is forecast to be well below the Active (1e8 integrated pfu) level throughout. MOSWOC REFM is considered good guidance with a below Active trend through the next 4 days.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: REFM

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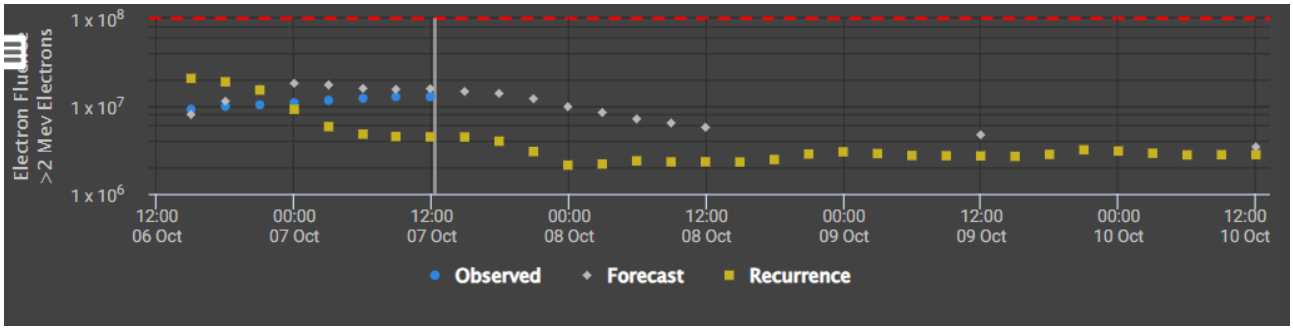

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